PB-251 563

GUIDELINES FOR QUALITY ASSURANCE PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS: PHASE III. LIGHT-DUTY DIESEL-POWERED VEHICLES - TEST PROCEDURES

Olson Laboratories, Incorporated

Prepared for:

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June 1975

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15. SUPPLEMENTARY NOTES This report is one of two volumes for Light Duty Diesel Powered Vehicles (Phase III). Other volumes have been issued for Phase I Light Duty Gasoline Powered Vehicles, Phase II Heavy Duty Diesel Engines and Phase IV Heavy Duty Gasoline Engines.

16. ABSTRACT

Test Procedures for Light Duty Diesel Powered Mobile Source Emissions Measurement Systems are presented with the concept of a total Quality Assurance System. The Test Procedures are presented in document control format and give the detailed test procedures with Quality Assurance provisions for each part of the total testing system. This volume is a supplement to EPA-650/4-75-024-b, Guidelines for QA Programs for Mobile Source Emissions Measurement Systems, Phase I, Light Duty Gasoline Powered Vehicles - Test Procedures.

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Gas Analysis		13B
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GUIDELINES FOR QUALITY ASSURANCE PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS:

PHASE III, LIGHT-DUTY DIESEL-POWERED VEHICLES - TEST PROCEDURES

by

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and

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Washington, D. C. 20460

June 1975

EPA REVIEW NOTICE

This volume has been prepared by Olson Laboratories, Incorporated consistent with the Environmental Protection Agency Quality Assurance principles and concepts and with the Environmental Protection Agency Mobile Source Testing Practices at Ann Arbor, Michigan.

The guidelines and procedures are generally applicable to mobile source testing operations and are intended for use by those engaged in such measurement programs

It is requested that recipients and users of this document submit any comments and suggestions to the Project Officers.

Mention of trade names or commercial products does not constitute Environmental Protection Agency endorsement or recommendation for use.

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INTRODUCTION

The test procedures contained in this supplement document the 1975 light duty diesel emission measurement test requirements presently in the use at the Ann Arbor facility of the Environmental Protection Agency. These test procedures comply with Federal Regulations as stated in the Federal Register. (Refer to Section 3, Volume I, for the listing of applicable Federal Register.)

All the test procedures applicable to the measurement of light-duty diesel vehicle emissions are listed in the Table of Contents. Since many of the procedures listed are identical to the procedures previously published for light-duty gasoline vehicles (Phase I, Volume II), they are not included in this supplementary document. Two procedures specifically written for light-duty diesel emission testing are identified with the letter suffix D, i.e., (TP703-D, TP707-D), and are included in this supplement.

The basic differences between the gasoline and diesel emission tests are (1) the elimination of the evaporation emissions test and (2) the continuous measurement of hydrocarbons with a heated flame ionization instrument (HFID), for diesel vehicles.

Both light-duty gasoline and diesel powered vehicles use the same data forms and computer programs, and are driven over the same FTP driving cycle.

Since the evaporative emissions test is not performed on diesel vehicles, preconditioning of the vehicle differs slightly, as presented in TP703-D. The procedures for the analysis of the exhaust from diesel vehicles is described in TP707-D.

This supplement is part of a series of publications in a four-phase program covering Quality Assurance Guidelines and test procedures for Mobile Source Emissions. The phases of the program are as follows:

Phase I Volume I - GUIDELINES FOR QA PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS
Light-Duty Gasoline-Powered Vehicles
a. Quality Assurance Guidelines

Volume II - GUIDELINES FOR QA PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS
Light-Duty Gasoline-Powered Vehicles
b. Test Procedures

Phase II Volume I - GUIDELINES FOR QA PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS
Heavy-Duty-Diesel Engines
a. Quality Assurance Guidelines

Volume II - GUIDELINES FOR QA PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS
Heavy-Duty Diesel Engines
b. Test Procedures

Phase III Volume I - GUIDELINES FOR QA PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS
Light-Duty Diesel Vehicles
a. Quality Assurance Guidelines

Volume II - GUIDELINES FOR QA PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS
Light-Duty Diesel Vehicles
b. Test Procedures

Phase IV Volume I - GUIDELINES FOR QA PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS
Heavy-Duty Gasoline Engines
a. Quality Assurance Guidelines

Volume II - GUIDELINES FOR QA PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS
Heavy-Duty Gasoline Engines
b. Test Procedures

TEST PROCEDURES FOR LIGHT DUTY DIESEL VEHICLES

T A B L E O F C O N T E N T S

Section		Page / Effective Date(s)
INTRODUCTION		
100	GAS BLENDING, FUEL ANALYSIS AND INVENTORY.	
101	Preparation of Binary Gas Mixtures	
102	Calibration of Gas Mixtures.	
200	CALIBRATION.	
201	CVS Calibration.	
202	Dynamometer Calibration.	
203	Gas Analyzer Calibration Curve Generation.	
204	Chart Recorder Calibration	
205	Temperature Recorder Calibration	
206	Barometric Pressure Calibration and Correlation.	
300	VERIFICATION	
301	CVS System Verification by Tracer Gas Injection.	
302	Dynamometer Calibration Verification	
303	NO_x Efficiency Check	
304	CO_2/H_2O Interference Check	
400	CORRELATION.	
401	Analyzer Cross Check	
500	MAINTENANCE.	
600	DAILY OPERATION.	
601	Log Book Entries	
602	Drift/Noise/Gain/Tune.	
603	Test Vehicle Scheduling.	
604	Dynamometer Warm-Up/Set.	
700	EMISSION TESTING	
701	Test Vehicle Inspection and Acceptance	
703-D	LA-4 Vehicle Preparation	
706	1975 Urban Dynamometer Test - FTP.	
707-D	Sample Analysis of 1975 FTP.	
709	Vehicle De-Prep and Removal	
710	Highway Fuel Economy Preconditioning	
711	Highway Fuel Economy Dyno Test - HWFET	
712	Sample Analysis of HWFET	
800	DATA VALIDATION.	
801	Data Validation.	
900	PROGRAM PLANNING AND QUALITY AUDIT	

EPA TEST PROCEDURE	Number TP-703-D	Page 1 of 4
SUBJECT "LA-4" VEHICLE PREPARATION - LIGHT DUTY DIESEL VEHICLES		
Reference FEDERAL REGISTER, VOL. 38, NO. 151, AUG. 7, 1973 VOL, 39, NO. 205, OCT. 22, 1974		Data Form No. 701-01; SECTION IV
Responsible Organization TEST OPERATIONS		Computer Program NONE
Test Witness /REVIEW MANUFACTURER'S REPRESENTATIVE, EPA CERTIFICATION ENGINEER		Performance Interval PER CERT.VEHICLE
Type of Test Report DATA SHEET		Supersedes NEW
Report Distribution QUALITY ASSURANCE, DATA VALIDATION, CERTIFICATION BRANCH, TEST DATA FILE		Superseded by
REMARKS/COMMENTS		

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab. Branch	Chief		
Lab. Branch	Test Operations Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

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1.0 PURPOSE

To prepare certification vehicles for the Federal exhaust emission test.

2.0 TEST ARTICLE DESCRIPTION

2.1 Test vehicle prepared by manufacturer

3.0 REFERENCES

3.1 Federal Register, Vol. 38, No. 151, Aug. 7, 1973 - 85.175-11

3.2 Federal Register, Vol. 39, No. 205, Oct. 22, 1974 - 85.376-11

4.0 REQUIRED EQUIPMENT

4.1 Chassis dynamometer

4.2 Drivers aid, Varian

4.3 Cooling fan

5.0 PRECAUTIONS

5.1 Assure vehicle is tied down with winch cable

5.2 Inflate tires to 45 psi

5.3 Insure room temperature is within 68° to 86°F.

6.0 VISUAL INSPECTION

6.1 Check for proper set-up of test equipment.

7.0 TEST ARTICLE PREPARATION

7.1 Add diesel test fuel to 40 percent of tank capacity. Fuel must be at ambient temperature (68-86°).
NOTE: Technician and witness must sign the "Fuel Log" located in fueling area.

7.2 Drive vehicle onto the dynamometer.

7.3 Install chocks at nondriving and attach the vehicle winch cable.

7.4 Hook up exhaust vent system to vehicle.

7.5 Place cooling fan in front of vehicle and turn fan on.

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8.0 TEST PROCEDURES

Test Sequence	Test Description	Data Output
101	Set inertia weight and hp per manufacturer's recommendation. Release dyno brake.	
102	Calibrate driver's aid at 50 mph and zero.	
103	Drive the hot LA-4, following tolerances stated in paragraph 85.075-14 of the Federal Register.	Driver's Chart
104	Upon completion of the LA-4 shut-off fan, engage the dyno brake, remove exhaust vent system, disconnect winch cable and remove chocks.	
105	Drive vehicle to soak area, shut-off engine, record the start time of the twelve hour soak.	Date, Time
106	Lock the vehicle and return the keys to the Production Control office.	

9.0 DATA INPUT

9.1 Insure Section IV of form 701-01 is complete.

9.2 Submit completed form and drivers trace to Data Validation.

10.0 DATA ANALYSIS

10.1 Check Section IV for missing data, and required signatures.

11.0 DATA OUTPUT

11.1 Form 701-01 becomes a permanent record of the test data package.

12.0 ACCEPTANCE CRITERIA

12.1 All entries must be complete and signed by the responsible technician and his supervisor.

12.2 Assure the LA-4 was driven within specified FTP driving limits. (see procedure #706, sec. 12.0)

12.3 Fuel must be at ambient temperature, 68-86^{o}F, when added to vehicles.

12.4 Soak area must be maintained at 68-86^{o}F. Vehicle must soak for a minimum of 12 hours from key off to key on, not to exceed a maximum of 20 hours.

13.0 QUALITY CONTROL PROVISIONS

13.1 If all entries and provisions stated in this procedure have been met, enter technicians EPA I.D. number on data sheet.

13.2 If soak time exceeds 20 hours precondition the vehicle again.

EPA TEST PROCEDURE	Number TP-707-D	Page 1 of 8

SUBJECT

SAMPLE ANALYSIS OF 1975 URBAN DYNO TEST - LIGHT-DUTY DIESEL VEHICLE

Reference FEDERAL REGISTER, VOLUME 38, NO. 151, Aug. 7, 1973 VOLUME 39, NO. 205, Oct. 22, 1974	Data Form No. 707-01-02
Responsible Organization TEST OPERATIONS	Computer Program SAQF:NEWCVS
Test Witness MANUFACTURER'S EPA REPRESENTATIVE, DATA VALIDATION	Performance Interval PER VEHICLE
Type of Test Report COMPUTER PRINT-OUT	Supersedes NEW
Report Distribution MAUFACTURER/CERTIFICATION/BRANCH/ DATA VALIDATION/QUALITY ASSURANCE	Superseded by

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt.	Quality Assurance		
Lab. Branch	Chief		
Lab. Branch	Test Operations Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

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1.0 PURPOSE

To measure the bag concentrations collected by a constant volume sampler. This exhaust sample is diluted to a constant volume and collected in sample bags. The collected sample is then analyzed for hydrocarbons, carbon monoxide, carbon dioxide and oxides of nitrogen by a gas analysis system. Hydrocarbons in the diluted sample are measured continuously using a heated flame ionization detector (HFID).

2.0 TEST ARTICLE DESCRIPTION

2.1 Test vehicle equipment preconditioned as outlined in TP-703-D.

3.0 REFERENCES

3.1 Federal Register. Vol. 38, No. 151, Aug. 7, 1973, sec. 85.175-18 (d), 20 and Vol. 39 No. 205, Oct. 22, 1974, sec. 85.376-18 (d), 20

3.2 EPA, Ann Arbor, Training Manual "Light Duty Certification Testing Procedures."

3.3 EPA, Ann Arbor, "Light Duty Test Operations," Draft.

4.0 REQUIRED EQUIPMENT

4.1 Constant Volume Sampler.

4.2 Mass Analytical System capable of measuring the following:

4.2.1 Hydrocarbons - FID

4.2.2 Hydrocarbons - Flame Ionization with heated sample line, filter and detector. (375±10°F)

4.2.3 Carbon Monoxide - Infra-red (NDIR)

4.2.4 Carbon Dioxide - Infra-red (NDIR)

4.2.5 Oxides of Nitrogen - Chemiluminescence

4.3 "Working" gas mixtures analyzed using EPA Primary Standards.

4.4 "Zero Gas", nitrogen and for NDIR, CL for FID, HFID.

4.5 FID fuel - 40 percent hydrogen, 60 percent nitrogen.

4.6 HFID fuel - 40 percent hydrogen, 60 percent helium.

5.0 PRECAUTIONS

5.1 Safety precautions should be followed when handling compressed gases. NO and CO are toxic gases!

5.2 Insure cylinders have at least 200 psig pressure.

5.3 Maximum time for bag analysis is 20 minutes following end of sample period.

6.0 VISUAL INSPECTION

6.1 Check flow rates and pressures on HFID.

6.2 During the FTP and during analysis mode, monitor all instruments, gauges, and recorders to assure no "out of spec" conditions exist.

7.0 TEST ARTICLE PREPARATION

7.1 Perform daily start-up on analyzer train. See operating instructions for HFID system in Attachment A.

7.2 Activate strip chart recorders and check zero/span

7.3 Install sample bags and insure no leaks are present.

7.4 Change CVS and HFID filter (sample) before FTP begins and during 10 minute soak. Also leak check CVS and HFID syster after changing filters.

7.5 Start ambient temperature recorder.

7.6 HFID sample system and electronics require 24 hours. Preheat sample line, filter and detector to required set point 375^{o}F ± 10^{o}.

8.0 TEST PROCEDURE

The 1975 Mass Emission Test results are calculated as a result of data collected from the following procedural steps.

SECTION 1. ANALYSIS OF CO_2 CO, AND NO BAG SAMPLES

Test Sequence	Test Description	Data Output
101	Prior to starting the first "505" of the FTP the analyzer operator will calibrate the analyzers and generate span points on the chart recorders.	
102	After the driver has switched to bags 2 and 4 upon completion of the "505" the Analyzer operator will deliver "bags 1 and 3" to the analysis transfer system.	
103	The analyzer operator will first analyze the "background" sample (bag 1) and log the numerical range and value from chart traces of CO, CO_2, HC NO_x on form 707-02.	BKGD. HC, Defl. CO, Defl. CO_2, Defl. NO_x - Sample
104	Step 103 is repeated for the "sample" bag. (bag 3)	Deflections, CO, CO_2, HC, NO_x - Sample
105	Counts, mileage and seconds are recorded for first set of bags on form 707-01, CVS Data sheet.	Revs, secs., mileage
106	Record the inlet and outlet pressure of the positive displacement plum on the CVS data sheet. During any idle period during the test.	Inlet pressure out, pressure in inches of fluid as specified
107	Recalibrate as shown in step 101.	
108	Upon completion of the transient phase of the FTP repeat steps 103 and 104 for "bags 2 and 4." Record on form 707-02.	Deflections, HC, CO, CO_2, and NO_x. BKGD. and sample
109	Record counts, mileage and seconds for second set of bags on CVS data sheet.	Revs., secs., mileage

Test Sequence	Test Description	Data Output
110	Recalibrate as shown in step 101 for final "505."	
111	Upon completion of "505" hot, repeat steps 103 and 104 for "bags 1 and 3."	Deflections, CO, CO_2, HC NO_x. BKGD. and sample.
112	Record rev. counts, mileage and seconds for the third set of bags.	Revs., secs., mileage
113	Perform a post calibration of analyzers and record on chart.	
114	Record the average wet and dry bulb temperatures, heat exhange temperature and barometric pressure on CVS data sheet (707-01).	W_B, °F D_B, °F T_{IN}, °F P_B In. Hg

SECTION II. ANALYSIS OF CONTINUOUS HYDROCARBON SAMPLE

201	Prior to starting the first 505 of the FTP the analyzer operator will calibrate the HFID and generate span and zero points on the chart recorder. Also generate HFID integrator calibration data as shown on HFID data sheet 707-D-01.
202	Check flow rate and sample back pressure. Note: Adjust span with gain setting rather than adjusting the back pressure regulator. Set HFID fuel, air, and sample pressure at valves prescribed for optimum response and minimum O_2 interferences.
203	Start the HFID recorder with the start of the CVS and sample pumps.
204	Set HFID integrators to zero.

Test Sequence	Test Description	Data Output
205	Turn on HFID analyzer system integrator and mark recorder chart at the same time as the start of engine cranking.	
206	At the end of the deceleration which is scheduled to occur at 505 seconds switch off HFID integrator No. 1 and start integrator No. 2. Mark recorder chart.	
207	Five seconds after engine stops running turn off HFID integrator No. 2. Mark recorder chart.	
208	Repeat sequences 201 and 202 during 10 minute soak period.	
209	Repeat sequences 205 and 206 for 505 hot start.	
210	Perform post calibration of HFID analyzer and record on chart.	
211	Record integrated HC results on manually integrated continuous chart for each portion of 75 FTP cycle, Determine the average HFID response and range number for each test phase using the data work sheet.	Average Deflection HC and Range No.

9.0 DATA INPUT

9.1 Check form 707-01 (CVS data sheet) and 707-D-01 (HFID data sheet) assure that all required data has been filled in.

9.2 Assure that numerical deflections of HC, CO, CO_2 and NO_x have been recorded on form 707-02 (Analyzer read-out) for each of the three phases of the FTP.

9.3 The Certification Branch representative and the Manufacturer's representative will inspect the CVS data sheet, driver's trace and CVS temp. trace. They will then sign CVS data sheet as valid or invalid.

9.4 Data Validation will validate form 707-01 and submit to Data Branch.

10.0 DATA ANALYSIS

10.1 Data analysis is performed by the SAQF:NEWCVS program.

10.2 Analysis is performed on Drivers Trace as stated in section 12 of procedure #TP-706.

10.3 Analysis of all other supporting data is performed by Data Validation.

11.0 DATA OUTPUT

11.1 The following information is entered into the vehicle test file.

- o CVS Data sheet form #707-01
- o Test cell ambient condition, records (^{o}F, WB, DB).
- o Analyzer trace
- o Drivers trace
- o CVS temp. trace
- o HFID Temperature trace
- o HFID Sample trace and data sheet
- o 702-01, DRIVER'S PRECONDITIONING REPORT
- o 705-01, VEHICLE TEST AND EVAPORATIVE DATA

11.2 Final copies of CVS data sheet and composite gram per mile results will go to the Certification Branch and the Manufacturer's representative.

12.0 ACCEPTANCE CRITERIA

12.1 Driver's trace must be within limits stated in section 12.0 of procedure #TP-706.

12.2 CVS temperature trace must be within $\pm 10^{\circ}F$ of set point for the entire test.

12.3 HFID temperature trace must be within $\pm 10^{\circ}F$ of set point for the entire test.

12.4 Manufacturer's representative must accept preliminary results as valid.

12.5 Analyzer post calibration must be within ±2 divisions of the initial span point.

12.6 Bag sample HC must be lower than continuous HC concentration value.

13.0 QUALITY PROVISIONS

13.1 Check tests results on an "audit" basis to assure acceptance criteria has been met.

13.2 Initiate corrective action if "out of spec" conditions are discovered. (i.e., Production Control will reschedule vehicle)

13.3 If HFID trace exceeds 99 percent of scale at any point during test invalidate test and repeat using next higher range.

DATA REDUCTION WORKSHEET FOR LD DIESEL HEATED FID MEASUREMENTS

VEHICLE/TEST INFORMATION

TEST DATE: __ - __ - __

TEST NUMBER: __ - _____

VEHICLE MODEL: _____

VEHICLE ID#: _____

DYNO/CVS NOS.: ____ - ____

HFID OPR. ID: _____

HFID INSTRUMENTATION DATA

FID AMPLIFIER

RANGE NO. | | |

F.S. VDC | | | MV

F.S. CONC. | | | PPMP

V/F CONVERTER

F.S. INPUT (.1) 1.0 10. VOLTS

F.S. OUTPUT 10,000 HZ

DIVIDE BY 1. (10.) 100.

(NORMAL SETTINGS CIRCLED)

	ZERO			SPAN			SAMPLE		ZERO			SPAN		
	DIV (A)	CNTS (B)	SECS (C)	DIV (D)	CNTS (E)	SECS F	RNG # G	CNTS	SECS (H)	DIV (I)	CNTS (J)	SECS (K)	DIV L	CNTS (M)	SECS (N)
BAG 1	•	•	•	•	•	•		•	•						
BAG 2								•	•	•	•	•	•	•	•
BAG 3	•	•	•	•	•	•		•	•	•	•	•	•	•	•
HWFET	•	•	•	•	•	•		•	•	•	•	•	•	•	•

CALCULATIONS:

$$\overline{\text{AVG DIV}}_1 = \left[\frac{1}{2}\right] \bullet \left[\frac{D - A}{E/F - B/C} + \frac{L - I}{M/N - J/K}\right] \bullet \left[\frac{G}{H}\right]$$

$$\overline{\text{PPMP}}_1 = \left[\frac{\text{F.S. PPMP}}{\text{F.S. DIV}}\right] \bullet \left[\overline{\text{AVG DIV}}_1\right]$$

CALCULATED VALUES:			HFID AVERAGE CONCENTRATIONS		CVS BAG AVERAGE CONCENTRATIONS	DIV.	PPMP	
BAG 1 $\overline{\text{AVG DIV}}$ =	•	DIV	$\overline{\text{PPMP}}$ 1 =	•	BAG 1	•	•	IS THE RATIO HFID/CVS PPMP GREATER THAN 1.0?
BAG 2 $\overline{\text{AVG DIV}}$ =	•	DIV	$\overline{\text{PPMP}}$ 2 =	•	BAG 2	•	•	
BAG 3 $\overline{\text{AVG DIV}}$ =	•	DIV	$\overline{\text{PPMP}}$ 3 =	•	BAG 3	•	•	
HWFET $\overline{\text{AVG DIV}}$ =	•	DIV	$\overline{\text{PPMP}}$ HW =	•	HWFET	•	•	

DO CHART ESTIMATES AGREE?

Form No. 707-D-01

ATTACHMENT A - FUNCTIONAL AND OPERATING
INSTRUCTIONS FOR HFID SYSTEM

A. SWITCH AND PUSHBUTTON - FUNCTION AND SETTING

1. MASTER SWITCH - upper panel - provides power for:
   SECONDARY MASTER SWITCH
   RECORDER
   TEMPERATURE READOUT
   2 FREQUENCY COUNTERS
   TIMERS
   12 VOLT POWER SUPPLY
   24 VOLT POWER SUPPLY for remote valve

2. SECONDARY MASTER SWITCH - bottom of rack - provides power for:
   VIDAR
   3 VARIACS
   2 front 115V outlets

3. POWER SWITCHES
   VIDAR - VOLTAGE to FREQUENCY CONVERTER
   3 VARIACS - control heated sample lines
   RECORDER
   2 FREQUENCY COUNTERS
   TEMPERATURE READOUT
   FID ELECTRONICS
   FID

4. PUCHBUTTONS - controls rotary valve position, timer start stop, counter start stop

   Cart panel
   - LOCAL - transfers control to cart panel
   - REMOTE - transfers control to remote box
   - TEST - starts counter and timer for selected bag
   - STANDBY - hold counter and timer on standby
   - BAG 1 & 3 - selects counter and timer
   - BAG 2 & 4 - selects counter and timer
   - ZERO - selects zero gas to FID
   - SPAN 1 - selects span 1 gas to FID
   - SPAN 2 - selects span 2 gas to FID
   - SAMPLE - selects sample gas to FID

   Remote box
   - TEST - starts counter and timer for selected bag
   - STANDBY - holds counter and timer on standby
   - BAG 1 & 3 - selects counter and timer
   - BAG 2 & 4 - selects counter and timer

5. SWITCH SETTINGS

MASTER SWITCH, ON
SECONDARY MASTER SWITCH, ON
VARIACS, ON (switch inside cabinet)
VIDAR - ON, - Input Selector .1 volt, - Divider Sitch, ÷ 10 (switches inside cabinet)
RECORDER - ON, STANDBY
TEMPERATURE READOUT - ON, 115V
COUNTERS, ON
FID ELECTRONICS, ON
FID, ON
PUSHBUTTONS, RELEASED, on local and remote panels

B. CHECKOUT, INITIALIZATION, AND USE

1. Checkout

SWITCHES, ON
PUSHBUTTONS released
COUNTER checkout
RESET, ON
INTERVAL, 10 seconds
DISPLAY, knob c.c.w. (counter clockwise)
SENSITIVITY, CHECK
displays 600 counts
COUNTER calibration (after FID zeroed and spanned, zero and span of FID should be done with recorder)
RESET, ON
INTERVAL, 10 seconds
DISPLAY, knob c.c.w.
SENSITIVITY, c.w. 1/4, turn adjust as needed
ZERO, depressed - record counts on each counter
SPAN, depressed - record counts on each counter
TIMER checkout
LOCAL, depressed
TEST, depressed (cart panel)
BAG 1 & 3, depressed (cart panel)
if timer is not counting depress timer bar to start

2. Initial test conditions

Panel and Box Pushbuttons, released
LOCAL or REMOTE, depressed
STANDBY, depressed (corresponding to above)
BAG 1 & 3, depressed (corresponding to above)
Rotary Valve, TEST
TIMER, zero
COUNTER INTERVAL, MANUAL
COUNTER MANUAL SWITCHES, EXTERNAL/OFF
RESET, both COUNTER displays and leave ON

3. Use 75 FTP

TEST, depressed on appropriate control panel when CVS sampling begins
BAG 2 & 4, depressed on appropriate control panel when CVS sampling begins for Bag 2 & 4
STANDBY, depressed on appropriate control panel when CVS sampling is stopped for Bag 2 & 4
Record, TIMER seconds, COUNTERS reading
TIMER, zero
RESET, both COUNTER displays and leave ON
BAG 1 & 3, depressed on appropriate control panel
TEST, depressed on appropriate control panel when CVS sampling begins for hot start
STANDBY, depressed on appropriate control panel when CVS sampling is stopped for Bag 1 & 3

4. Use EPA Highway Cycle

TEST, depressed on appropriate control panel when CVS sampling begins
STANDBY, depressed on appropriate control panel when CVS sampling ends
Record, TIMER seconds, COUNTER display

C. NOTES:

If sample/standby, Bag 1 & 3, Bag 2 & 4 pushbuttons are depressed on control panel which has not been selected, the units will function normally except that the indicator lights will remain lighted on both panels for all buttons depressed.

If sample/standby, Bag 1 & 3, Bag 2 & 4 pushbuttons are released on control panel which has not been selected, both control panels will show position selected.

Rotary valve does not light until it is in selected position.

When selecting a span gas, ZERO GAS must be selected FIRST. It is not possible to switch directly from R2 span to R1 span even though panel lights will change to R1.